Montana Fish, Wildlife & Parks
2300 Lake Elmo Drive
Billings, MT 59105
July 26, 2013

TO: Environmental Quality Council
Director's Office, Dept. of Environmental Quality
Montana Fish, Wildlife & Parks*
- Director's Office
- Parks Division
- Fisheries Division
- Wildlife Division
- Lands Section
- Design & Construction
- Legal Unit
- Regional Supervisors

Tim Baker, Governor's Office *
Judy Beck, Press Agent, Governor's Office *
Montana Historical Society, State Preservation Office
Janet Ellis, Montana Audubon Council *
Montana Wildlife Federation *
Montana State Library *
George Ochenski *
Montana Environmental Information Center *
Wayne Hirst, Montana State Parks Foundation *
FWP Commissioner Matt Tourtlotte*
Montana Parks Association/Our Montana (land acquisition projects)
Matt Wolcott, DNRC Area Manager, Southern Land Office *
County Commissioners *
Other Local Interested People or Groups
* (Sent electronically)

Dear Interested Party:

Montana Fish, Wildlife & Parks (FWP) has developed a draft Environmental Assessment (EA) prepared for the proposed action of continuing Yellowstone cutthroat restoration in Sage Creek in Carbon and Bighorn Counties in Montana. This draft EA addresses two issues. The first is the recent discovery in July 2013 of brook trout in the upper reaches of the North Fork of Sage Creek. The population appears to be isolated above the original project area in a reach of stream that was considered fishless when surveyed in 2010. The section with brook trout was not surveyed in 2012 as it was considered fishless. A few cutthroat trout were stocked above the waterfall in 2010, crews in 2013 were asked to determine if any of those fish remained after high water in 2011. That crew subsequently discovered brook trout. Several adult brook trout and more age 1 and young-of-year brook trout were captured during annual survey work. The 2011 water year likely improved habitat conditions in this reach and the few previously undetected adults have successfully spawned both years since. FWP and other cooperators would like to chemically remove these brook trout in August of 2013 before the adults spawn in September and before fish potentially move downstream into the larger project area. Additionally the EA

approved in 2010 for this effort had a timeline that ended in 2012. This updated EA proposes to extend the timeframe for this effort through 2018. Survey efforts in 2012 and in 2013 didn't find brook trout in the larger project area. It is anticipated this treatment will remove the last brook trout in the Sage Creek drainage and future treatments would be unnecessary. If however brook trout migrate downstream beyond the 2013 treatment area it will be necessary to treat the drainage again.

The EA is available at: www.fwp.mt.gov - "Recent Public Notices". If you would like to request a printed version of the EA contact the Region 5 Office at (406) 247-2940. Questions and comments on the EA will be accepted through August 10th, 2013.

Written comments can be mailed to the following address:

Yellowstone Cutthroat Restoration Project in Sage Creek
Montana Fish, Wildlife & Parks
2300 Lake Elmo Drive
Billings, MT 59105

Or email comments to: kfrazer@mt.gov

Thank you for your interest on this project.

Sincerely,

Gary Hammond
Montana Fish, Wildlife & Parks
Region 5 Regional Supervisor
Billings, MT

Enclosed: Draft Environmental Assessment, "Sage Creek Native Yellowstone Cutthroat Trout Restoration Project 2013 through 2018" and "Yellowstone Cutthroat Trout Restoration in Sage Creek" final EA published in July 2010.

MONTANA FISH WILDLIFE & PARKS

MEPA/NEPA CHECKLIST

PART I. PROPOSED ACTION DESCRIPTION

1. Type of Proposed State Action:

   This proposed action is part of native fish restoration efforts aimed at restoring Yellowstone cutthroat trout in its historic range in Montana. The Sage Creek trout reintroduction project has been ongoing with the initial removal attempt conducted in 2010. In 2011 brook trout were found in the lower portion of the South Fork of Sage Creek and a second treatment was conducted in portions of the South Fork, North Fork and main stem Sage Creek. No brook trout were found in 2012 during survey work. Recently in July of 2013 brook trout were found in the very upper reaches of the North Fork on the Crow Reservation and Forest service lands as well as a portion on private land. This area was not part of the initial treatment as it was thought to be fishless above a perceived rock barrier. The population appears to be only in this upper reach at this time as brook trout were not found below the barrier since the original treatment in 2010. This EA proposes to allow FWP staff and cooperators to chemically remove brook trout remaining in Sage Creek. The intended treatment would occur in August of 2013 to ensure any adults don't spawn this fall.

   Additionally this EA is proposed to allow additional treatments in the future should brook trout be found again during annual survey work. The area covered by this time extension are the 4th order HUC's Sage Creek Section House Draw and Sage Creek North Fork Sage Creek as shown on map 1.

   This Document is supported by a previous EA titled, "Yellowstone Cutthroat Trout Restoration in Sage Creek" (YCTRSG) published on July 12th, 2010. The document is attached for reference and is referenced in several locations within this document.

2. Agency Authority for the Proposed Action:

   Authority to conduct the proposed actions comes from the Montana Administrative Code,
   (87-1-702). Specifically, this statue authorizes Montana Fish, Wildlife & Parks "to perform such acts as may be necessary to the establishment and conduct of fish restoration and management projects.

   The Bureau of Indian Affairs (BIA) as the Trustee for acreage within the Crow Reservation is obligated to protect and preserve Indian trust assets from loss, damage, unlawful alienation, waste, and depletion. As such, approval of the proposed project will be necessary for the restoration project. In order to authorize this funding an assessment complying with the National Environmental Policy Act is necessary. This EA provides that assessment, and the BIA is a joint lead Agency

with the FWP in preparation of this document.

The Crow Tribal Fish and Wildlife Department also has jurisdiction over fisheries conservation projects. The department's responsibilities include management of Crow Tribal fish and wildlife resources on the Crow Reservation. The Crow Tribal Fish and Wildlife Department has contributed funds and resources towards this project.

3. Name of Project: Sage Creek Native Yellowstone Cutthroat Trout Restoration Project 2013 through 2018.

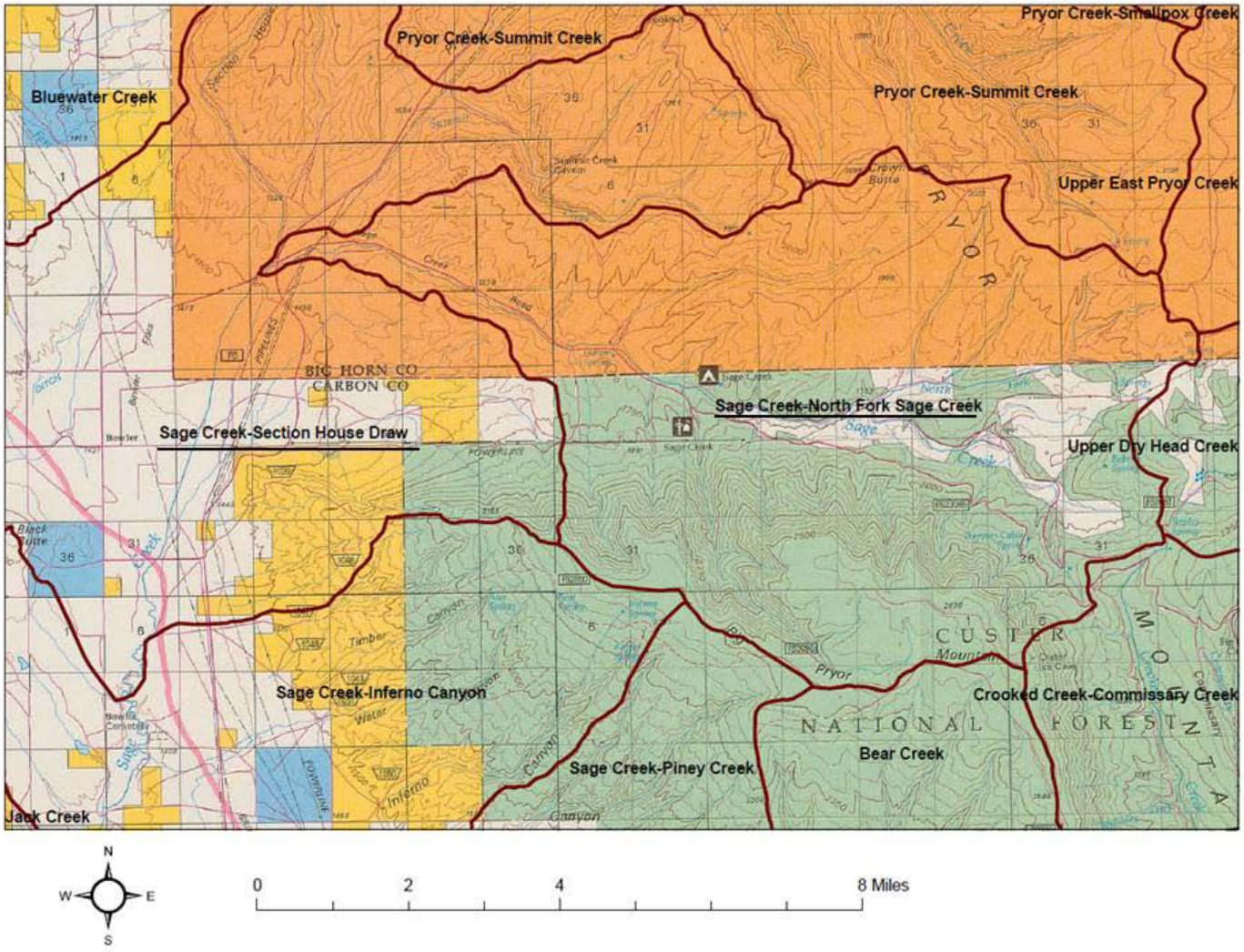
4. Name, Address and Phone Number of Project Sponsor (if other than the agency): Montana Fish Wildlife and Parks, Mike Ruggles, 2300 Lake Elmo Drive, Billings MT 59105

5. If Applicable:
   Estimated Construction/Commencement Date: August 13th, 2013
   Estimated Completion Date: August 16th, 2013 or subsequent years if brook or rainbow trout are found.
   Current Status of Project Design (% complete): 95%
6. Location Affected by Proposed Action (county, range and township): Carbon County 7S26E section 24, 7S27E section 19, 20 and Bighorn County 7S26E section 13, 7S27E section 18,17 as shown in map 2.. Additionally if necessary other sections in the Sage Creek basin in the two describe Huc's if non-native trout are found in the future as shown in map 1
   .
7. Project Size: Estimate the number of acres that would be directly affected that are currently:

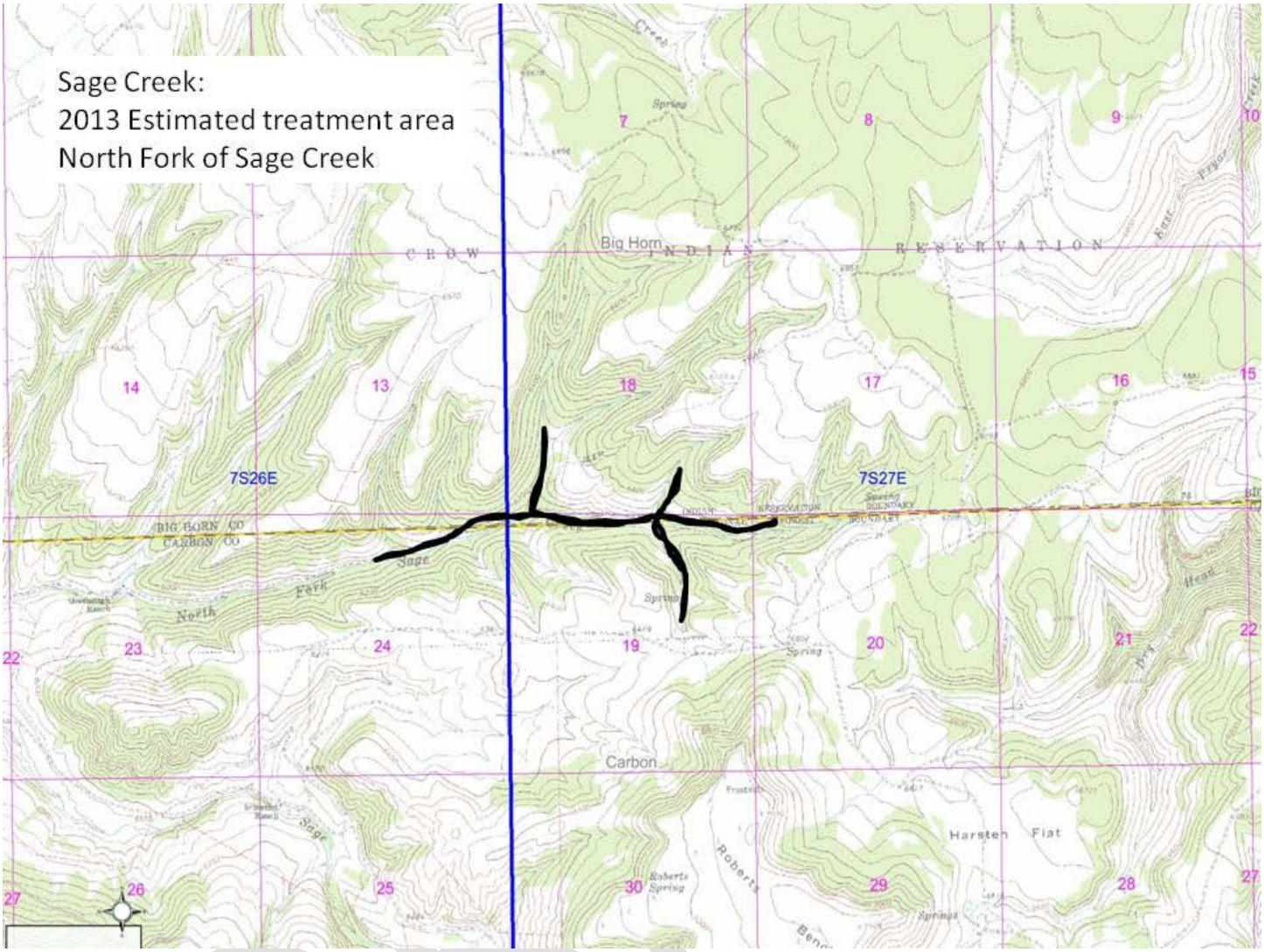
	Acres		Acres
(a) Developed: 0		(d) Floodplain: 0	
Residential 0			
Industrial: 0		(e) Productive: 0	
		irrigated cropland:0	
(b) Open Space/Woodlands/Recreation:		dry cropland: 0	
		Forestry: 0	
(c) Wetlands/Riparian Areas: 2 miles		Rangeland:0	
		Other:0	

8. Map/site plan: attach an original 8 1/2" x 11" or larger section of the most recent USGS 7.5' series topographic map showing the location and boundaries of the area that would be affected by the proposed action. A different map scale may be substituted if more appropriate or if required by agency rule. If available, a site plan should also be attached.

Maps 1 and 2 are provided to cover both objectives of this EA.



Map 1. Overview of the Sage Creek Project includes Sage Creek-North Fork Sage Creek and Sage Creek-Section House Draw areas.



Map 2. Proposed 2013 area in the upper portion of the North Fork drainage.

9. Listing of any other Local, State or Federal agency that has overlapping or additional jurisdiction.

(a) Permits: MTDEQ
Permit : 308 NOI#MTG870052
Date Filed/#: July 13th, 2012 valid until Oct, 31 2016

(b) Funding: Montana Fish Wildlife and Parks
Agency Name:
Funding Amount:
within current
budget

(c) Other Overlapping or Additional Jurisdictional Responsibilities:
Agency Name: Crow Tribe, US Forest Service

10. Narrative summary of the proposed action or project including the benefits and purpose of the proposed action: This action would remove the threat of brook trout for Yellowstone Cutthroat restoration in Sage Creek. The remaining drainage to Bowler Flats has been treated and appears to have successfully removed brook trout. Yellowstone cutthroat have been restocked and have been growing well. Several local anglers have been successfully finding and fishing for the cutthroat trout and have been very happy with the effort. Natural reproduction is expected in 2014 or 2015 from the first stocked cutthroat. Brook trout often out compete cutthroat. This recently found growing population of brook trout threatens all past work conducted since 2010.

11. List of agencies consulted during preparation of the EA: USFS, USFWS, Crow Tribe, USBIA.

PART II. ENVIRONMENTAL REVIEW

1. Evaluation of the impacts of the Proposed Action including secondary and cumulative impacts on the Physical and Human Environment.

This checklist is identical to the list in the, "Yellowstone Cutthroat Restoration in Sage Creek, Environmental Assessment Addendum" signed July 12, 2010. This EA identifies a known need for treatment in 2013 and extends the intent of the original EA for 5 years in the event other brook trout are found in the original project area.

1.1.1. Land Resources

Land Resources Would the proposed action result in:	Impact Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Soil instability or changes in geologic substructure?		X				
b. Disruption, displacement, erosion, compaction, moisture loss, or over-covering of soil which would reduce productivity or fertility?		X				
c. Destruction, covering or modification of any unique geologic or physical features?		X				
d. Changes in siltation, deposition or erosion patterns that may modify the channel of a river or stream or the bed or shore of a lake?		X				
e. Exposure of people or property to earthquakes, landslides, ground failure, or other natural hazard?		X				

1.1.2. Air

Air	Impact					
Would the proposed action result in:	Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Emission of air pollutants or deterioration of ambient air quality?		X				
b. Creation of objectionable odors?			X			2b
c. Alteration of air movement, moisture, or temperature patterns or any change in climate, either locally, or regionally?		X				
d. Adverse effects on vegetation, including crops, due to increased emissions of pollutants?		X				
e. Exposure of people or property to earthquakes, landslides, ground failure, or other natural hazard?		X				

Comments on 2b:

Alternative 1: Proposed Action

According to the material safety data sheet (MSDS) for CFT Legumine, this compound has a slight solvent odor. Respiratory protection is required when working with undiluted product in a confined space. Likewise, the MSDS for n-methylpyrrolidone, an emulsifying agent in CFT Legumine does not require respiratory protection when handling in a well-ventilated area. As CFT Legumine will be applied outside, the objectionable solvent odor will likely dissipate rapidly, presenting a minor and temporary creation of objectionable odors. FWP personnel with experience applying CFT Legumine indicate it has only a very slight odor and is not disagreeable to work with.

Alternative 2: No Action

This alternative would not result in creation of objectionable odors.

1.1.3. Water (see Addendum A for updated information by Carol Endicott)

Water	Impact					
Would the proposed action result in:	Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Discharge into surface water or any alteration of surface water quality including but not limited to temperature, dissolved oxygen or turbidity?			X		YES	3a
b. Changes in drainage patterns or the rate and amount of surface runoff?		X				
c. Alteration of the course or magnitude of flood water or other		X				

flows?				
d. Changes in the amount of surface water in any water body or creation of a new water body?	X			
e. Exposure of people or property to water related hazards such as flooding?	X			
f. Changes in the quality of groundwater?	X			3f
g. Changes in the quantity of groundwater?	X			
h. Increase in risk of contamination of surface or groundwater?		X	YES	see 3f
i. Effects on any existing water right or reservation?	X			
j. Effects on other water users as a result of any alteration in surface or groundwater quality?	X			3j
k. Effects on other users as a result of any alteration in surface or groundwater quantity?	X			
l. Would the project affect a designated floodplain?		X	YES	3l
m. Would the project result in any discharge that would affect federal or state water quality regulations? (Also see 2a)		X	NO	See 3a

Comments 3a: Discharge into surface waters
Alternative 1: Proposed Action
As this project proposes discharge of a piscicide into Sage Creek, this impact would be unavoidable. Nonetheless, discussion of the nature of the piscicide, physical setting, and mitigative actions provide a framework to predict the severity and spatial extent of the impacts.

Rotenone is an insecticide commonly used in organic agriculture and home gardening, as well as being an effective piscicide. Rotenone is extracted from the roots and stems from a variety of tropical and subtropical plants in the pea family (Fabaceae). The empirical formula of this isoflavonoid compound is $C_{23}H_{22}O_6$. Carbon comprises 70% of its molecular weight, and hydrogen and oxygen constitute 6% and 24% respectively. Compared to other piscicides, rotenone is relatively inexpensive and accessible, and has been routinely used to remove unwanted fish from lakes and streams. Rotenone acts by blocking the ability of tissues to use oxygen, which causes fish to asphyxiate quickly.

Rotenone is a highly reactive molecule, a factor favoring its quick decomposition in the environment. This degradability is in marked contrast to some pesticides used in nonorganic agriculture. Organochlorines are synthetic pesticides comprised of chlorinated hydrocarbons, and include chemicals such as DDT, heptachlor, and chlordane. These compounds persist in the environment long after their

release, making the behavior and fate of organochlorine pesticides substantially different from rotenone.

Organophosphates are another class of pesticide that differs markedly from rotenone in terms of threats to human health and the environment. Commonly used organophosphate pesticides include malathion, parathion, and diazinon. Although these chemicals are considerably less persistent than the organochlorines, they are more acutely toxic, and act as potent neurotoxins. Organophosphate poisonings are one of the most common causes of poisoning worldwide. In contrast, rotenone does not share this acute toxicity to humans with the organophosphate pesticides.

CFT Legumine, is the rotenone formulation proposed for this project. This chemical is registered by the EPA (Reg. No. 75338-2) and approved for use as a piscicide. Information on its chemical composition, persistence in the environment, risks to human health, and ecological risks come from a number of sources including material data safety sheets (MSDS) and manufacturer's instructions. (An MSDS is a form detailing chemical and physical properties of a compound, along with information on safety, exposure limits, protective gear required for safe handling, and procedures to handle spills safely.) In addition, a recent study presented an analysis of major and trace constituents in CFT Legumine, evaluated the toxicity of each, and examined persistence in the environment (Fisher 2007).

The MSDS for CFT Legumine list three categories of ingredients for this formula (Table 2-1). Rotenone comprises 5% of CFT Legumine by weight. Associated resins account for 5%, and the remaining 90% are inert ingredients, of which the solvent n-methylpyrrolidone is a component. Additional information in the MSDS confirms its extreme toxicity to fish. The TVL addresses risks to human health from exposure, which is addressed in 8a.

Fisher (2007) analyzed chemical composition of CFT Legumine, including the inert fraction (Table 2-2). On average, rotenone comprised 5% of the formula, consistent with MSDS reporting. Other constituents were solvents or emulsifiers added to assist in the dispersion of the relatively insoluble rotenone. DEGEE, or diethyl glycol monoethyl ether, a water-soluble solvent, was the largest fraction of the CFT Legumine analyzed. Likewise, n-methylpyrrolidone comprised about 10% of the CFT Legumine. The emulsifier Fennedofo 99™ is an inert additive consisting of fatty acids and resin acids (by-products of wood pulp and common constituents of soap formulations), and polyethylene glycols (PEGs), which are common additives in consumer products such as soft drinks, toothpaste, eye drops, and suntan lotions. Trace constituents included low concentrations of several forms of benzene, xylene, and naphthalene. These organic compounds were considerably lower than measured in Prenfish, another commercially available formulation of rotenone, which uses hydrocarbons to

disperse the piscicide. Their presence in trace amounts is related to their use as a solvent in extracting rotenone from the original plant material.

Table 2-1: Composition of CFT Legumine from material safety data sheets (MSDS)

Chemical Ingredients	Percentage by Weight	CAS No.[1]	TLV[2] (Units)
Rotenone	5.00	83-79-4	5 mg/m^3
Other Associated Resins	5.00		
Inert Ingredients Including n-methylpyrrolidone	90	872-50-4	Not listed

[1]Chemical Abstracts Number
[2]A TLV reflects the level of exposure that the typical worker can experience without an unreasonable risk of disease or injury.

Table 2-2: Average percent concentrations and ranges of major constituents in CFT Legumine lots to be used in a piscicide project in California (Fisher 2007).

Major CFT Legumine™ Formula Constituent	*Rotenone*	*Rotenolone*	*Methylpyrrolidone*	*DEGEE[1]*	*Fennedefo 99™*
Average %	5.12	0.718	9.8	61.1	17.1
Range	4.64-5.89	0.43-0.98	8.14-10.8	58.2-63.8	15.8-18.1

[1]diethyl glycol monoethyl ether

Toxicity to nontarget organisms and persistence in the environment are important considerations in determining the potential risks to human health and the environment, and several factors influence rotenone's persistence and toxicity. Rotenone has a half-life of 14 hours at 24 °C, and 84 hours at 0 °C (Gilderhus et al. 1986, 1988), meaning that half of the rotenone is degraded and is no longer toxic in that time. As temperature and sunlight increase, so does degradation of rotenone. Higher alkalinity (>170 mg/L) and pH (>9.0) also increase the rate of degradation.

The local geology and timing of treatment will promote rapid breakdown of rotenone. Sage Creek drains a limestone catchment, a factor that promotes higher alkalinity, and therefore, favors rapid breakdown of rotenone. The available alkalinity data for Sage Creek are limited to two sampling events in the 1970s that found alkalinity of 185 and 204 mg/L1, concentrations that promote quick breakdown. Water temperatures in late August and early September will be relatively warm, which will likewise contribute to degradation of rotenone. In this chemical and physical environment, rotenone would be reduced to nontoxic levels in one to several days due to its degradation and dilution in the aquatic

1 EPA STORET database (www.epa.gov/storet)

environment.

Mitigative activities proposed in this supplement will further reduce the spatial and temporal extent of rotenone. If surface flows are present, a detoxification station will be established immediately below the treatment reach, which will release about 4 mg/L of $KMnO_4$. This strong oxidizer rapidly breaks down rotenone into nontoxic constituents of carbon, oxygen, and hydrogen. $KMnO_4$ in turn breaks down into potassium, manganese, and water, which are common constituents in surface waters, and have no deleterious effects at the concentrations used (Finlayson et al. 2000). The result of release of $KMnO_4$ on water quality will be elimination of toxic concentrations of rotenone.

Concentration of rotenone in treated waters is another factor relating to potential effects from incidental ingestion by other organisms, including humans. The effective concentration of rotenone is 1 ppm or 1 mg/L, which is well below concentrations harmful to humans from ingestion. The National Academy of Sciences found concentrations at 14 ppm would pose no adverse effects to human health from chronic ingestion of water (NAS 1983). Moreover, concentrations associated with acute toxicity to humans are 300-500 mg per kilogram of body weight (Gleason et al. 1969), which means a 160-pound person would have to drink over 23,000 gallons in one sitting to receive a lethal dose (Finlayson et al. 2000). Similarly, risks to wildlife from ingesting treated water are low. For example, ¼ pound bird would have to consume 100 quarts of treated water, or more than 40 pounds of fish and invertebrates within 24 hours for a lethal dose (Finlayson et al. 2000). The EPA, in their recent reregistration evaluation of rotenone (EPA 2007), concluded that there are no unacceptable risks to humans and wildlife from exposure to rotenone when applied according to label instructions. In summary, this project would have no adverse effect on humans or wildlife associated with ingesting water, dead fish, or dead invertebrates.

Bioaccumulation of rotenone would not result in threats to human health and the environment under this alternative. Rotenone bioaccumulates in the fat tissues of fish that are not exposed to toxic levels (Gingerich and Rach 1985). As a complete fish-kill is the goal, bioaccumulation would not be a problem.

Potential toxicity and persistence of the other constituents of the CFT Legumine formulation are additional considerations. Proposed concentrations of n-methylpyrrolidone (about 2 ppm) would have no adverse effects to humans ingesting treated waters. According to the MSDS, ingestion of 1000 ppm per day for three months does not result in deleterious effects to humans. In addition, given its high biodegradability, n-methylpyrrolidone will not persist in surface waters. In fact, this feature, combined with its low toxicity, makes n-methylpyrrolidone a commonly used solvent in wastewater treatment plants.

Fisher (2007) examined the toxicity and potential persistence of other major constituents in CFT Legumine, including DEGEE, fatty acids, PEGs, and trace organic compounds, (benzene, xylene, naphthalene). With proposed application of CFT Legumine, none of these compounds would violate water quality standards, nor would they reach concentrations shown to be harmful to wildlife or humans. Furthermore, persistence of these chemicals was not a concern. The trace organics would degrade rapidly through photolytic (sunlight) and biological mechanisms. Likewise, the PEGs would biodegrade in a number of days. The fatty acids are also biodegradable, but would persist longer than the PEGs or benzenes. Nonetheless, these are not toxic compounds, so the relatively longer persistence would not adversely affect water quality. Overall, the low toxicity, low persistence, and lack of bioaccumulation indicate the inert constituents in CFT Legumine would have a minor and temporary effect on water quality.

To reduce the potential risks associated with the use of CFT Legumine the following management practices, mitigation measures, and monitoring efforts would be employed:

1. A pretreatment bioassay would be conducted to determine the lowest effective concentration and travel time.
2. Signs will be posted at trailheads and along the stream to warn people not to drink the water or consume dead fish.
3. Piscicides would be diluted in water and dripped into the stream at a constant rate using a device that maintains a constant head pressure.
4. A detoxification station would be set up downstream of the target reach. Potassium permanganate ($KMnO_4$) would be used to neutralize the piscicide at this point.
5. An additional detoxification will be established above the boundary between BLM and private land to as a safeguard.
6. Project personnel would be trained in the use of these chemicals including the actions necessary to deal with spills as prescribed in the MSDS for CFT Legumine
7. Persons handling the piscicide would wear protective gear consistent exposure control/personal protection gear as prescribed in the MSDS for CFT Legumine.
8. Only the amount of piscicide and potassium permanganate that is needed for immediate use would be held near the stream.
9. Sentinel or caged fish would be located below the detoxification station and within the target reach to determine and monitor the effectiveness of both the rotenone and potassium permanganate. Yellowstone cutthroat trout obtained from a state hatchery would be the species used in monitoring toxicity.

Alternative 2: No Action

This alternative would have not result in discharge into surface water and

would have no impact.

Comment 3f: Changes in groundwater quality
Alternative 1: Proposed Action
The risk that rotenone would enter and be mobile in groundwater is minimal because it has a strong tendency to bind to organic soil particles (Dawson et al. 1991), and has a low solubility in water. Once bound to organic molecules, rotenone becomes inert and breaks down quickly in the environment without detoxification. Moreover, rotenone would be detoxified with $KMnO_4$ at the downstream boundary of the project. Even if groundwater contamination did occur, no consequences for human health would occur because the surface water concentrations to be used in this project have already been shown to have no toxic effect on humans or other mammals (see 2a). Furthermore, the chance for exposure to rotenone is minimal given the location of domestic water sources. The following factors suggest very little, if any, rotenone would reach any wells:

1. Virtually all piscicide that reaches these points would have already been broken down by natural conditions or been oxidized by KMnO4;
2. Any remaining piscicide would likely be bound up by sediments before entering groundwater; and
3. Any piscicide that enters groundwater would be diluted by water already present in the aquifer.
4. Monitoring of domestic wells adjacent to previous rotenone treatments in Montana and California has failed to detect rotenone or any inert ingredients.

Alternative 2: No Action
This alternative would have no impact of groundwater.

Comment 3j: Effects on other water users
Timing piscicide application for late summer through early fall would result in no effects on other water users. Swimming and irrigation are the only uses with potential to be affected by rotenone. Swimming in rotenone treated water is prohibited until the chemical has been thoroughly mixed. Crops should not be irrigated with rotenone treated water because of potential effects on beneficial invertebrates. As swimming and irrigation are unlikely during the treatment window, this action would have no effect on these uses.

1.1.4. Vegetation

Vegetation	Impact					
Would the proposed action result in:	Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Changes in the diversity, productivity or abundance of plant species (including trees,		X				

shrubs, grass, crops, and aquatic plants)?				
b. Alteration of a plant community?	X			
c. Adverse effects on any unique, rare, threatened, or endangered species?	X			4c
d. Reduction in acreage or productivity of any agricultural land?	X			
e. Establishment or spread of noxious weeds?		X	YES	4e
f. Would the project affect wetlands, or prime and unique farmland?	X			

COMMENT 4c: Effects on any unique, rare, threatened, or endangered species.

The NHP maintains a database detailing presence and status of species of special concern, including unique, rare, threatened, or endangered species. Included in this information is ranking information that details state and range-wide status of plants and animals (Table 3). Potential threats to plants of concern would be surface disturbance associated with trampling by fish crews.

Table 3: NHP's ranking system (G = global or range wide, S = state or within Montana

Code	*Description*
G1 S1	At high risk because of extremely limited and/or rapidly declining numbers, range, and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.
G2 S2	At risk because of very limited and/or declining numbers, range, and/or habitat, making it vulnerable to global extinction or extirpation in the state.
G3 S3	Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas.
G4 S4	Uncommon but not rare (although it may be rare in parts of its range), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern.
G5 S5	Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.
B	Breeding population in Montana
T	Infraspecific Taxon (trinomial) –The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank.

Three plants of special concern are known to occur within or adjacent to the Sage Creek watershed (Table 4). Both the beartooth large-flowered goldenweed and the Cary's beardtongue are endemic to the Pryor Mountains. Their restricted native distribution provides the rationale for inclusion as species of special concern. Both species are typical of uplands, and would be unlikely to be encountered by fish crews operating near the stream. The goldenweed is likely tolerant of mechanical disturbance as it benefits from livestock grazing.

Jove’s buttercup has been observed in the adjacent Crooked Creek watershed, which suggests its occurrence in the Sage Creek watershed is possible. Nonetheless, suitable habitat for this species includes sagebrush grasslands and open forest slopes, so field crews working streamside would be unlikely to encounter this plant. In addition, this plant completes its sensitive reproductive stages (flowering and fruiting) by early June.

Overall, potential impacts to sensitive plant species would be negligible. All three species tend to occur in uplands; whereas, the bulk of the activity would occur immediately adjacent to the stream. Nevertheless, field personnel would be provided field guide information on these special plants to avoid inadvertent impacts during application of piscicide.

Table 4: Plant species of special concern known to occur in or adjacent to the Sage Creek watershed.

Common Name	*Scientific Name*	*Natural Heritage Ranks*	*Known Distribution*
Beartooth large-flowered goldenweed	*Haplopappus carthamoides* var. *subsquarrosus*	State: S1S2 Global:G4G5T2T3	Occurs in Sage Creek drainage (T7S, R26E, Section 30)
Cary's beardtongue	*Penstemon caryi*	State:S3 Global: G3	Occurs adjacent to Sage Creek drainage (T7S, R27E, Section 31)
Jove's buttercup	*Ranunculus jovis*	State: S2 Global: S4	Occurs adjacent to Sage Creek drainage (T7S, R27E, Section 32)

COMMENT 4e: Establishment or spread of noxious weeds
Alternative 1: Proposed Action
Trucks and four wheelers transporting gear and personnel have potential to spread noxious weeds from seeds transported in the undercarriage. To mitigate and reduce the risk of invasion or spread of noxious weeds, all vehicles would be cleaned before arrival on site, including an undercarriage wash.

Alternative 2: No action.
This alternative would have no effect on spread on establishment or spread of noxious weeds.

1.1.5. Fish and Wildlife

Fish and Wildlife	**Impact**				
Would the proposed action result in:	**Un-known**	**None**	**Minor**	**Potentially Significant**	**Can Impact Be Mitigated**	**Comment Index**
a. Deterioration of critical fish or wildlife habitat?		X				
b. Changes in the diversity or abundance of game animals or bird species?			X		YES	5b
c. Changes in the diversity or abundance of nongame species?			X		NO	5c
d. Introduction of new species into an area?		X				
e. Creation of a barrier to the migration or movement of animals?		X				
f. Adverse effects on any unique, rare, threatened, or endangered species?			X		YES	5f
g. Increase in conditions that stress wildlife populations or limit abundance (including harassment, legal or illegal harvest or other human activity)?		X				
h. Would the project be performed in any area in which T&E species are present, and would the project affect any T&E species or their habitat? (Also see 5f)		X				
i. Would the project introduce or export		X				

any species not presently or historically occurring in the receiving location? (Also see 5d)

Comment 5b: Changes in the diversity or abundance of game animals or bird species?

Alternative 1: Preferred Action

This proposed action would alter fish community composition in Sage Creek. Currently, this portion of Sage Creek supports nonnative brook trout and rainbow trout. This project would remove these species; however, reintroduction of Yellowstone cutthroat trout would mitigate the loss of these species.

As discussed in 2.1.3 Water, exposure to rotenone through ingestion of treated water or dead fish presents no threat to wildlife because of its low toxicity when ingested. Nonetheless, reductions in aquatic prey species, both fish and sensitive macroinvertebrates, may have a negative effect on species relying on prey of aquatic origin. Reintroduction of Yellowstone cutthroat trout, and recovery of the population would restore the forage base for predators relying on fish within a few years.

Mink (*Mustela vison*) are semi-aquatic predators, and the Sage Creek watershed is within their range in Montana. (Northern river otter [*Lontra canadensis*], another semi-aquatic predator, has an inferred range that encompasses the upper Sage Creek watershed; however, as a small stream, habitat suitability for otters is marginal at best.) As opportunistic predators, mink prey on a variety of terrestrial and aquatic species, including small mammals, birds, reptiles, and amphibians, allowing flexibility in response to temporary reductions in fish abundance. Over the short-term, mink would have reduced availability of fish; however, recovery of the reintroduced Yellowstone cutthroat trout population would restore fish as a food source within 3 to 4 years.

Invertivorous birds would also have potential to be affected by reductions in macroinvertebrate populations. The American dipper (*Cinclus mexicanus*) is the species typically considered in effects analysis relating to rotenone treatment, as this species consumes benthic macroinvertebrates as its primary food source. The NHP does not extend the breeding range of the American dipper into the Pryor Mountains, although another source provides incidental evidence of dippers breeding in the general area (Bergeron et al. 1992), and an active dipper nest was observed in 2008 in neighboring Crooked Creek (FWP, unpublished data). If present in the Sage Creek watershed, impacts on dippers would be minor and temporary. First, not all invertebrates would succumb to piscicide treatment, resulting in a remaining forage base in treated waters. Non-gill bearing invertebrates and those in the egg phase would still be present in Sage Creek. In addition, macroinvertebrate populations recover biomass rapidly following this type of disturbance, making the decrease in forage availability a

short-term alteration. Project timing would also limit the effect on other invertivorous birds, as many of these migratory species would not be present in late summer through early fall.

Implementing the project in late summer through early fall would also reduce potential effects on birds that consume aerial invertebrates with an aquatic life history stage. Many neotropical passerines begin their southward migration in late August, and would be no longer present, or leaving the project area during treatment.

Alternative 2: No Action
This alternative would have no impact on game or bird species.

Comment 5c: Changes in the diversity or abundance of nongame species?
Alternative 1: Proposed Action
In addition to the nonnative game species targeted for removal, Sage Creek likely supports numerous vertebrates, primarily reptiles and amphibians, and associated aquatic life such as benthic macroinvertebrates. Rotenone is toxic to organisms that respire through gills, which include fish, larval amphibians, and some macroinvertebrates such as mayflies, caddis flies, and stone flies.

Fish surveys in upper Sage Creek have found only brook trout and rainbow trout; however, warm water fishes may extend into the lower portions of the project area. Before treatment, these waters would be surveyed

Detailed surveys of amphibian distribution are lacking for this part of Montana; however, several sources allow inference on the potential for species to occur in upper Sage Creek. First, range maps provided by the NHP's field guide provide a coarse indication of species potentially present. Next, examination of the database of observations maintained by the NHP allows identification of observations with the Sage Creek or neighboring drainages. Finally, habitat preference information allowed evaluation of the suitability for aquatic habitat in the project area to support adult or larval forms.

Amphibians with potential to occur in the project area include toads, frogs, and a salamander (Table 5). Plains spadefoot, boreal chorus frogs, and tiger salamanders have been observed in or near a reservoir on an unnamed tributary of Sage Creek, about 14 miles downstream of the project area. Although the reservoir may contribute to clustering of three species there, as some of the only public land in the lower drainage, this also represents an opportunity for state biologists to sample without needing permission, which contributes to clustering of observations. Northern leopard frogs have been observed in the Pryor Creek drainage, at an elevation similar to the project area. Woodhouse's toads have been frequently seen along the Clark's Fork of the Yellowstone, to the west of the Sage Creek drainage. Overall, amphibians likely to occur within Sage

Creek probably make incidental use of the stream, as most prefer standing waters for breeding or foraging. Amphibians with the greatest potential for exposure to rotenone will be those using the seeps in the stream's headwaters, which may provide habitat for both adult and juvenile amphibians.

Table 5: Amphibians likely to occur in the Sage Creek watershed, timing for metamorphosis, and nearest observation to the Sage Creek Yellowstone cutthroat trout reintroduction project (information from NHP field guide.

Common Name	*Scientific Name*	*Metamorphosis Timing*	*Nearest Observation*
Plains spadefoot	*Spea bombifrons*	Variable	Sage Creek drainage
Woodhouse's toad	*Bufo woodhousii*	Tadpoles present to early September	Clark's Fork of the Yellowstone drainage
Boreal chorus frog	*Pseudacris maculatua*	8 weeks	Sage Creek drainage,
Northern leopard frog	*Rana pipiens*	July to September	Pryor Creek watershed
Tiger salamander	*Ambystoma tigrinum*	2 to 3 years at higher elevation	Sage Creek drainage

The influence of piscicides on amphibians varies with reproductive strategy, life history stage, and, in the case of tiger salamanders, life form. (Under conditions of a secure water source, usually a lake or reservoir, tiger salamanders may retain gills as adults. This life form is unlikely to occur in Sage Creek.) Similar to other gill-bearing organisms, amphibian larvae are sensitive to rotenone, and exposure to rotenone at levels used to kill fish is acutely toxic to Columbian spotted frog larvae (Grisak et al. 2007). Timing application of piscicide in late summer to fall would be protective of most amphibians, as they would be past their vulnerable, gilled stage of development. Moreover, frogs and salamander prefer standing waters for reproduction and rearing, so their presence in Sage Creek would be unlikely or incidental, with seeps in the stream's headwaters being the only likely locations for larval frogs and salamanders. The plains spadefoot relies on ephemeral waters following large storm events for reproduction, making presence of larvae highly unlikely in the marshy, seeps area.

Tiger salamanders have a considerably longer period as gill-retaining larvae, which may extend to three years. Nonetheless, consideration of key life history strategies suggests that tiger salamander populations that may be present in the marshy seeps in upper Sage Creek, will be minor and temporary. Notably, tiger salamanders are resilient to loss of a year class (Bryce Maxell, NHP, personal communication). Frequently, the older year class of tiger salamander larvae will cannibalize the newer generation. This strategy ensures the success of the older year class, resulting in staggered year class success.

Toxicity of rotenone to adult amphibians is comparatively low and relates to the species aquatic respiration, and their probability of entering or occurring in treated waters (Maxell and Hokit 1999). Although no information is available on the toxicity of rotenone on species potentially present in Sage Creek is available, investigations on other adult amphibians indicate adult amphibians do not suffer an acute response to trout killing concentrations of Prenfish, another commonly used formulation of rotenone (Grisak et al. 2007). Effects on adult Woodhouse's toads would be negligible given their impermeable skin and terrestrial affinities. Northern leopard frogs can respire through their skin; however, they are not wholly dependent on the aquatic environment and can leave, making them less likely to suffer mortality (Maxell and Hokit 1999). Although this species has declined in the western portion of Montana, it is relatively secure in the eastern portions of the state, which suggests this project would have minor, if any effect, on northern leopard frogs.

No observational data or other records were available documenting painted turtles in Sage Creek and only one observation was available for the Montana portion of the Shoshone hydrologic unit (Maxell et al. 2003). Nonetheless, the NHP includes the Sage Creek watershed within its range. According to Maxell and Hokit (1999), piscicides can be toxic to turtles, especially those capable of aqueous respiration such as snapping turtles (*Chelydra serpentina*) and spiny softshell (*Trionyx spiniferus*), species not present in Sage Creek. Most probably, painted turtles are less vulnerable than snapping turtles and spiny softshells, as they were not included among turtles capable of aquatic respiration, and are more likely to transverse terrestrial environments. Because of its secure status throughout its range, its presumed rarity in Sage Creek, and its ability to leave contaminated waters, impacts on painted turtles would likely be minimal.

Three species of snake with affinity for water have ranges that encompass the Sage Creek watershed. All are gartersnakes, and consume a variety of prey items, including amphibians. As timing of piscicide application will not coincide with sensitive, early life history stages of their amphibian prey, and risks to exposure from ingestion are low, this project will not adversely affect the three gartersnake species with potential to occur along Sage Creek.

Table 6: Vertebrates present or potentially present in Sage Creek (MFISH database, Maxell et al. 2003, Montana Natural Heritage field guide [http://fieldguide.mt.gov/])

Class	*Species*	*Scientific Name*	*Use of Sage Creek*	*Abundance*
Osteichthyes (bony fishes)	Rainbow trout	*O. mykiss*	Year round resident	Abundant
	Brook trout	*S. fontinalis*	Year round resident	Abundant

Amphibia (amphibians)	Tiger salamander	*Ambystoma tigrinum*	Potentially present, prefer lentic waters. Two observations are available for a reservoir on a tributary of Sage Creek (T8NR24Esection24)	Unknown
	Woodhouse's toad	*Bufo woodhousii*	Potentially present, adults partly terrestrial but found near water	Unknown
	Northern leopard frog	*Rana pipiens*	Potentially present, prefer densely vegetated sedge-meadows or cattail marshes	Unknown
Reptilia (reptiles)	Painted turtle	*Chrysemys picta*	Potentially present, prefer environments with soft, mud bottoms, and little to no current	Unknown
	Common gartersnake	*Thamnophis sirtalis*	Potential present around streams	Unknown
	Plains gartersnake	*T. radix*	Potential present around streams	Unknown
	Terrestrial gartersnake	*T. elegans*	Potential present around streams	Unknown

Rotenone is lethal to benthic invertebrates with gills such as mayflies, stone flies, and caddis flies. The predicted effect would be a temporary decrease in some invertebrate taxa. These populations rebound quickly from many types of disturbance through two primary mechanisms. Invertebrates drift as a normal component of their life history strategies, so untreated, fishless headwaters would provide a source of invertebrates. Likewise, aerial adults would supplement drift by laying eggs in Sage Creek allowing for recovery of sensitive invertebrates within one year. Additionally, applying piscicide in late summer or early fall would coincide with relatively low numbers of gilled invertebrates, as most would have emerged to complete their life cycle. A large proportion of taxa will be present in the stream as eggs, which are tolerant of rotenone.

Information specific to macroinvertebrate community composition in upper Sage Creek is lacking; however, investigations in nearby streams allow inference on potential for Sage Creek to support rare or unique invertebrates. Neighboring streams tend to have similar water quality, geology, and thermal regime, which result in a tendency to support similar macroinvertebrate communities. Moreover, as most of the sensitive, gill-bearing invertebrates disperse as winged adults, nearby streams will share the same species.

Dry Head Creek lies to the east of the divide between the Shoshone and Big Horn River hydrologic units (Figure 3). In 1999, US Forest Service personnel collected macroinvertebrate samples from Dry Head Creek within the Custer National Forest. This site was within two miles of the headwaters of Sage Creek. Species composition was typical of healthy mountain streams in Montana. No unknown or unique invertebrates were present in the three kick samples collected (McGuire 2000).

Punch Bowl Creek is adjacent to Sage Creek, and is a tributary of Dry Head Creek (Figure 3). Macroinvertebrate data collected for this stream in 2004 (FWP, unpublished data) showed an assemblage consistent with a healthy, mountain Montana stream. Similar to Dry Head Creek, no rare or unique invertebrates were present in the sample.

In summer of 2007, NHP personnel sampled the upper reach of Pryor Creek (Figure 3). This stream is also a close neighbor of Sage Creek, and likely to share many of its invertebrate taxa. Similar to Dry Head Creek, invertebrates present in Pryor Creek were typical of healthy mountain streams (NHP unpublished data). Moreover, no rare or unique taxa were present in samples. Combined, the Dry Head Creek, Punch Bowl Creek, and Pryor Creek macroinvertebrate data suggest piscicide treatment of Sage Creek would not affect rare macroinvertebrate taxa in Sage. Furthermore, these neighboring streams provide a source for recolonization from winged adults.

Monitoring will allow evaluation of the effects of piscicide treatment on macroinvertebrates in Sage Creek. Macroinvertebrates will be sampled before treatment in 2010, and monitored yearly afterwards for 2 years to evaluate the effects on community composition and abundance.

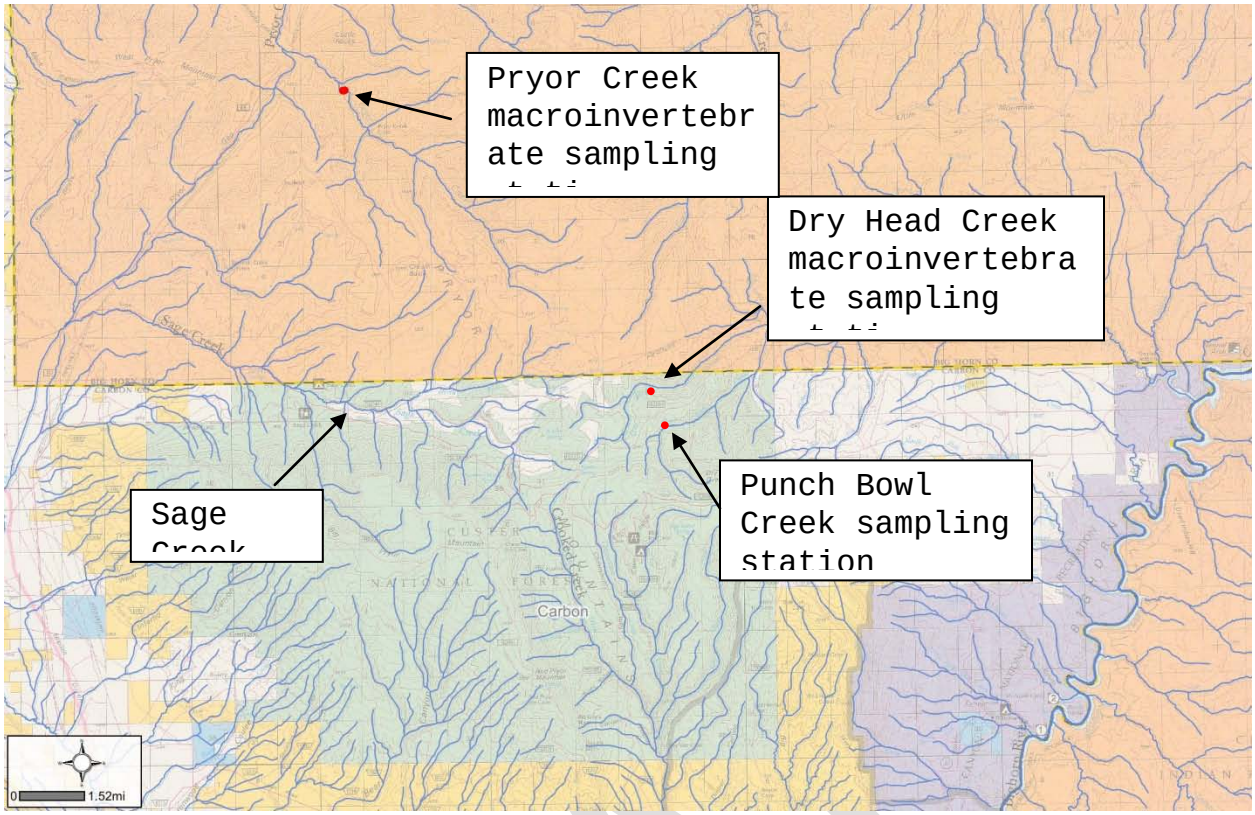


Figure 2-1: Map of Sage Creek, Pryor Creek, and Dry Head Creek showing proximity of macroinvertebrate sampling stations to Sage Creek.

Comment 5f: Adverse effects on any unique, rare, threatened, or endangered species

The NHP database lists several vertebrate species of special concern as occurring in or near the Sage Creek watershed (Table 2-7). Field guide information provided by the NHP website allows inference on potential impacts to these species. Evaluation of their habitat needs, forage base, presumed distribution, and migration timing suggests impacts to these species would be nonexistent or negligible.

Bald eagles have wide distribution in Montana, and are likely to make at least incidental use of Sage Creek. As discussed in Comment 5b, effects of the project on bald eagles would be minor and temporary given their preference for larger streams.

Three species of bat listed as species of special concern have inferred distributions that encroach close to, but do not enter the Sage Creek watershed. As bats feed on aerial insects, a temporary reduction in invertebrates produced in Sage Creek has potential to affect bats. Habitat observations and diet information provided by the NHP suggest that these species do not rely on invertebrates with an aquatic life history stage. Spotted bats (*Euderma maculatum*) forage over mesic to arid environments and specialize on moths. Likewise, Townsend's big-eared bats (*Corynorhinus townsendii*) consume mostly moths, although other taxa listed

in their diet preferences include terrestrial invertebrates such as wasps and beetles. Although some moths have an aquatic early life history stage, most are of terrestrial origin. The pallid bat (*Antrozous pallidus*) also tends to forage over arid to mesic shrublands or forests. Its diet is varied, with terrestrial invertebrates comprising the bulk of the listed taxa. Given the arid to mesic habitat affinities of these three species of bats, combined with the apparent lack of reliance on invertebrates with an aquatic life history stage, the preferred option would likely have a negligible affect on these species. Moreover, the other species of bat occurring in this area would suffer minor if any impact owing to a lack of reliance on invertebrates of aquatic origin.

Songbird species of special concern occurring near the project area include the sage thrasher and bobolink. The preferred alternative would unlikely to have an impact on either species for a host of reasons. Timing piscicide application to late summer or early fall would avoid sensitive nesting and breeding periods. Moreover, both species begin their fall migration in mid-August, so few if any birds would remain during treatment. Habitat suitability is another issue. As the name suggests, sage thrashers prefer mesic sagebrush and grasslands, making their presence near Sage Creek incidental. Likewise, bobolinks are a grassland bird, preferring open meadows. The combination of project timing and narrow extent of human activity (within the riparian corridor) makes adverse affects on either species highly unlikely.

The Plains spadefoot is a species of special concern documented to be present in the Sage Creek watershed. As noted in Comment 5c, the Plains spadefoot would be highly unlikely to experience adverse effects from piscicide treatment. This species of toad has impermeable skin and is not capable of aquatic respiration. Moreover, its reproductive strategy involves use of ephemeral standing waters formed by large storm events. Therefore, no larval spadefoot would likely be present in Sage Creek, including its marshy headwaters.

The western hognose snake is a species of special concern with limited potential to occur in the Sage Creek watershed. The NHP considers its range to encompass most of the eastern two-thirds of Montana; however, relatively few records are available for the state (Maxell et al. 2003). None are in or near the Sage Creek watershed. Little is known about its preferred habitat or habits in Montana, although this species typically consumes toads as its primary prey. If western hognose snake does occur in the upper Sage Creek watershed, negative effects on this species would likely be negligible. Piscicide treatment would have little effect on its forage base, as application would occur after the sensitive larval stage of toads and frogs.

Table 2-7: Vertebrate species of special concern known to occur in or near the Sage Creek watershed.

Common Name	*Scientific Name*	*Natural Heritage Ranks*	*Known/Inferred Distribution*
Bald eagles	*Halieatus leucocephalus*	G5S3	Nearest known nest is about 14 miles away.
Spotted bat	*Euderma maculatum*	G4S2	Higher elevations in Sage Creek watershed (T8S R26E Sections 1-5)
Pallid bat	*Antrozus pallidus*	G5S2	Adjacent to Sage Creek watershed (T7S, R27E, Section 32)
Townsend's big-eared bat	*Corynorhinus townsendii*	G4S2	Higher elevations in Sage Creek watershed (T7S, R27E Sections 29, 31, and 32)
Bobolink	*Dolichonyx oryzivorus*	G5S2B	Uplands to the northwest of project area.
Sage thrasher	*Oreoscoptes montanus*	G5S3B	Uplands to the southwest of the project area.
Plains spadefoot	*Spea bombifrons*	G5S3	Documented in the Sage Creek watershed
Western hognose snake	*Heterodon nasicus*	G5S2	Known from several sightings in the neighboring, Big Horn River basin

1.2. Human Environment

1.2.1. Noise and Electric Effects

	Impact					
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**	**Can Impact Be Mitigated**	**Comment Index**
a. Increases in existing noise levels?		X				
b. Exposure of people to serve or nuisance noise levels?		X				
c. Creation of electrostatic or electromagnetic effects that could be detrimental to human health or property?		X				
d. Interference with radio or television reception and operation?		X				

1.2.2. Land Use

Would the proposed action result in:	Impact: Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Alteration of or interference with the productivity or profitability of the existing land use of an area?		X				
b. Conflicted with a designated natural area or area of unusual scientific or educational importance?		X				
c. Conflict with any existing land use whose presence would constrain or potentially prohibit the proposed action?		X				
d. Adverse effects on or relocation of residences?		X				

1.2.3. Risks/Health Hazards

Would the proposed action result in:	Impact: Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Risk of an explosion or release of hazardous substances (including, but not limited to oil, pesticides, chemicals, or radiation) in the event of an accident or other forms of disruption?			X		YES	8a
b. Affect an existing emergency response or emergency evacuation plan or create a need for a new plan?		X				
c. Creation of any human health hazard or potential hazard?			X		YES	see 8c
d. Would any chemical piscicides be used?			X		YES	see 8a and 3a

Comment 8a: Risk of explosion or release of hazardous substances
Alternative 1: Proposed Action
Use of rotenone constitutes a release of a substance hazardous to fish and other gill-respiring organisms. See comments 3a on risks to the environment and human health, and mitigative actions to minimize adverse effects.

MSDSs for CFT Legumine and $KMnO_4$, describe risks of explosion for these compounds. With a flashpoint of 192 °F (89 °C), CFT Legumine has a low risk of combustion or explosion. Special caution is required for transporting and using materials with a flashpoint of less than 140 °F (60 °C). Nevertheless, foam or CO_2 fire extinguishers would be available during transport and handling or undiluted product. $KMnO_4$ is nonflammable,

but has an explosion hazard when in contact with organic or readily oxidizable compounds. Such materials would not be at the project site, which eliminates the risk of explosion from $KMnO_4$ reacting with other chemicals.

Alternative 2: No Action
This alternative presents no risk of explosion or release of hazardous substances.

Comment 8b: Creation of a human health hazard or potential hazard.
Alternative 1: Proposed Action
Hazards to human health relate to handling non-dilute CFT Legumine and $KMnO_4$. (As described in 2.1.3 Water, application of CFT Legumine or $KMnO_4$ to surface waters according manufacturer's instructions does not present a risk to human health from exposure to treated water.) To prevent health risks associated with skin contact and inhalation, workers handling full strength CFT Legumine would follow exposure controls/personal protection requirements detailed in the MSDS and the label. Workers with potential to be exposed to non-dilute CFT Legumine would wear chemical resistant gloves, boots, protective eyewear and respirators.

$KMnO_4$ presents a potential human health hazard with skin contact, inhalation, or ingestion. Personnel working with the non-dilute product would follow safety practices detailed in the MSDS for $KMnO_4$. This includes gloves and eye protection.

Accidental spills present another potential avenue for threats to human health from either CFT Legumine or $KMnO_4$. In the event of a spill, workers would follow accidental release measures detailed in the MSDSs for each compound, which involve containment and disposal Protective eyewear and gloves are required to handle spills.

Alternative 2: No Action
This alternative would not create a human health hazard or potential hazard.

1.2.4. Community Impact

Would the proposed action result in:	Impact Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Alteration of the location, distribution, density, or growth rate of the human population of an area?		X				
b. Alteration of the social structure of a community?		X				
c. Alteration of the level or distribution of employment or community or personal income?		X				
d. Changes in industrial or commercial activity?		X				
e. Increased traffic hazards or effects on existing transportation facilities or patterns of movement of people and goods?		X				

10. PUBLIC SERVICES/TAXES/UTILITIES **Will the proposed action result in:**	**IMPACT *** Unknown *	None	Minor *	Potentially Significant	Can Impact Be Mitigated *	Comment Index
a. Will the proposed action have an effect upon or result in a need for new or altered governmental services in any of the following areas: fire or police protection, schools, parks/recreational facilities, roads or other public maintenance, water supply, sewer or septic systems, solid waste disposal, health, or other governmental services? If any, specify:		x				
b. Will the proposed action have an effect upon the local or state tax base and revenues?		x				
c. Will the proposed action result in a need for new facilities or substantial alterations of any of the following utilities: electric power, natural gas, other fuel supply or distribution systems, or communications?		x				
d. Will the proposed action result in increased used of any energy source?		x				
e. **Define projected revenue sources		x				
f. **Define projected maintenance costs.		x				
g. Other:						

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):

**** 11. AESTHETICS/RECREATION**	**IMPACT ***	**Can**	

Will the proposed action result in:	Unknown *	None	Minor *	Potentially Significant	Impact Be Mitigated *	Comment Index
a. Alteration of any scenic vista or creation of an aesthetically offensive site or effect that is open to public view?		x				
b. Alteration of the aesthetic character of a community or neighborhood?		x				
c. **Alteration of the quality or quantity of recreational/tourism opportunities and settings? (Attach Tourism Report)		x				
d. ***For P-R/D-J, will any designated or proposed wild or scenic rivers, trails or wilderness areas be impacted? (Also see 11a, 11c)		x				
e. Other:						

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):

12. CULTURAL/HISTORICAL RESOURCES Will the proposed action result in:	IMPACT *				Can Impact Be Mitigated *	Comment Index
	Unknown *	None	Minor *	Potentially Significant		
a. **Destruction or alteration of any site, structure or object of prehistoric historic or paleontological importance?		x				
b. Physical change that would affect unique cultural values?		x				
c. Effects on existing religious or sacred uses of a site or area?		x				
d. ****For P-R/D-J, will the project affect historic or cultural resources? Attach SHPO letter of clearance. (Also see 12.a)		x				
e. Other:						

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):

C. SIGNIFICANCE CRITERIA

13. SUMMARY EVALUATION OF SIGNIFICANCE Will the proposed action, considered as a whole:	IMPACT *				Can Impact Be Mitigated *	Comment Index
	Unknown *	None	Minor *	Potentially Significant		
a. Have impacts that are individually limited, but cumulatively considerable? (A project or program may result in impacts on two or more separate resources that create a significant effect when considered together or in total.)		x				
b. Involve potential risks or adverse effects which are uncertain but extremely hazardous if they were to occur?		x				
c. Potentially conflict with the substantive requirements of any local, state, or federal law, regulation, standard or formal plan?		x				
		x				

d. Establish a precedent or likelihood that future actions with significant environmental impacts will be proposed?						
e. Generate substantial debate or controversy about the nature of the impacts that would be created?		x				
f. ***For P-R/D-J, is the project expected to have organized opposition or generate substantial public controversy? (Also see 13e)		x				
g. ****For P-R/D-J, list any federal or state permits required.						308 discharge DEQ

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Water Resources (Attach additional pages of narrative if needed):

PART II. ENVIRONMENTAL REVIEW, CONTINUED

1. Description and analysis of reasonable alternatives (including the no action alternative) to the proposed action whenever alternatives are reasonably available and prudent to consider and a discussion of how the alternatives would be implemented:

   Alternative 1. Nonnative fish eradication followed by native fish introduction. Remove brook trout and if found rainbow trout using piscicide and stock Yellowstone cutthroat trout to replace the population. This is the preferred alternative.

   Alternative 2. No Action. Don't remove remaining non natives which would likely expand and retake the rest of Sage Creek and loose all progress made with cutthroat restoration.

   Alternative 3. Mechanical removal of non-native fish. Non natives found during survey work have been removed. Juvenile fish are not very susceptible to mechanical capture. In July dozens of young of year brook trout were seen but not collected due to habitat complexities. This effort would take substantially more time and funds than a single day chemical treatment. It has a high likely hood of failure with brook trout likely out migrating due to disturbance.

More detailed discussion of the original alternatives are still relevant and are as follows:

Four alternatives received consideration during preparation of the environmental assessment. The proposed alternative (alternative 1) and no action (alternative 2) were evaluated in detail. Two additional alternatives were eliminated from full consideration, as they were more expensive, less feasible, and would have a low probability of meeting project objectives, namely establishment of a genetically pure population of Yellowstone cutthroat trout.

1.3. Alternatives Given Detailed Study

1.3.1. Alternative 1: Nonnative fish eradication followed by native fish introduction

The proposed action includes removal of brook and rainbow trout in a 28-mile reach of Sage Creek using piscicide. Removal of nonnative fishes would eliminate the threats associated with predation, competition, and hybridization. The anticipated outcome would be complete removal of brook and rainbow trout from the project area, because piscicides have been demonstrated to be 100% effective with use of proper techniques. The predicted consequence of alternative 1 is establishment of a

genetically pure, self-sustaining population of Yellowstone cutthroat trout.

This alternative differs from the original (FWP 2008), in that the treated area is expanded from 10 miles to 28 miles of stream. In addition, instead of a phased treatment, where the upper 1.1 miles would be treated the first year, and the remainder treated in subsequent years, the entire length would be treated the first year. Additional treatments may occur in two subsequent years if monitoring found incomplete removal of nonnatives.

A primary consequence of increasing the amount of stream habitat treated and elimination of the phased approach is a reduced forage base of predators on aquatic invertebrates and fish over a greater area beginning in the first year. As biomass of invertebrates rebounds quickly following disturbance, the effect would be minor and of short duration. Timing treatment during fall coincides with a period when many macroinvertebrate taxa have completed their life cycle, and the next generation is within eggs and not vulnerable to piscicide. Drift and dispersal of aerial adults from neighboring drainages would result in recovery of the diversity of invertebrate assemblage within a few years. Predators consuming fish would have a longer period without this forage base; however, reintroduction of Yellowstone cutthroat trout would restore this food source within 4 years.

Mitigative measures associated listed under the comments in the environmental review would minimize the amount of piscicide used and reduce the risk of exposure to humans and livestock. Consequently, this alternative would have a minor effect on state waters while being economically, environmentally, and technologically feasible. Compared to electrofishing or angling (alternative 3), the use of piscicide takes less time and money in removing nonnative fish, which gives this option the greatest economic feasibility. Likewise, the combination of low persistence of these chemicals in the environment, and the mitigative steps to reduce environmental impacts, makes this an environmentally feasible alternative. As piscicides can be 100% effective in removal, this alternative is also technically feasible.

1.3.2. Alternative 2: No action.

The predicted consequence of the "No Action" alternative is that a Yellowstone cutthroat trout population in Sage Creek would not be restored, and brook and rainbow trout would flourish.

1.4. Alternatives Considered but Not Given Detailed Study

1.4.1. Alternative 3: Introduction of Yellowstone cutthroat trout without removal of existing fish populations.

This alternative would not allow attainment of the purpose of the project, namely establishment of a genetically pure population of Yellowstone cutthroat trout. Rainbow trout are well established in this portion of Sage Creek, and would likely hybridize with reintroduced Yellowstone cutthroat trout. To a lesser extent, the abundance of brook trout is also likely to limit the success of this project, given the high reproductive potential of brook trout in Sage Creek, and the tendency of brook trout to displace Yellowstone cutthroat trout in small streams. Because the continued presence of brook trout and rainbow trout is incompatible with establishment of a sustainable, pure population of Yellowstone cutthroat trout, this alternative was not evaluated in detail. These factors render this alternative technically and economically infeasible.

1.4.2. Alternative 4: Introduction of Yellowstone cutthroat trout with mechanical removal of existing fish populations.

This alternative is the same as the proposed action, except no piscicides would be used. Removal of

fish would be by mechanical means only, including both electrofishing and angling. Angling is the least effective of these methods, and an estimated 20% of fish can be removed this way on an annual basis. Reproduction from year-to-year would nullify much of this effect. Angling is also a particularly inefficient method for removing small fish. Electrofishing is also inefficient at removing small fish, and effectiveness on Sage Creek would likely to be 5-80% depending upon the staff and the amount of cover in the stream. Habitat complexity in Sage Creek would provide refugia from the electrical current and netting, which would prevent full removal of brook trout and rainbow trout. The remaining rainbow trout would spawn with Yellowstone cutthroat trout resulting in hybridization. Similarly, competition with the remaining brook trout would jeopardize persistence of Yellowstone cutthroat trout.

This alternative is economically and technologically infeasible because of the uncertainties associated with the success, and the number of years that would be required before efforts even close to 100% success could be guaranteed. This would need to be conducted continually on a one or two year basis. Costs would be $6,000 to $12,000 per year and provisions would have to be made to staff this project on an annual or biannual basis. These time delays would not only cost more money, but would also slow the process of Yellowstone cutthroat trout recovery.

2. Evaluation and listing of mitigation, stipulation, or other control measures enforceable by the agency or another government agency:
   (This section provides an analysis of impacts to private property by proposed restrictions or stipulations in this EA as required under 75-1-201, MCA, and the Private Property Assessment Act, Chapter 462, Laws of Montana (1995). The analysis provided in this EA is conducted in accordance with implementation guidance issued by the Montana Legislative Services Division (EQC, 1996). A completed checklist designed to assist state agencies in identifying and evaluating proposed agency actions, such as imposed stipulations, that may result in the taking or damaging of private property, is included in Appendix A.)

PART III. NARRATIVE EVALUATION AND COMMENT

The actions requested in this document are twofold. First, address the known population of brook trout found in an untreated section of Sage Creek that was previously thought to be fishless. The 2011 runoff apparently improved habitat conditions and potentially connected isolated brook trout which in turn produced offspring from the 2012 and 2013 years based on size of brook trout caught in July 2013. Three years of survey work below the perceived rock barrier and the upper extent of the original treatment has never documented a brook trout. Additionally, local anglers have been satisfied with the resulting cutthroat and have not caught a brook trout since the first treatment. It's believed the known brook trout are above the barrier. Removal actions would include a buffer below the barrier to better insure the brook trout were removed. Second, the EA would extend the timeframe for future removals if necessary for the next 5 years.

PART IV. EA CONCLUSION SECTION

1. Based on the significance criteria evaluated in this EA, is an EIS required (YES/NO)? If an EIS is not required, explain why the EA is the appropriate level of analysis for this proposed action.

Evaluation of potential impacts on the physical and human environment provides the basis for determining the need for an environmental impact statement (EIS), which is a more rigorous evaluation of potential impacts to

human health and the environment from the proposed action. If evaluation of these significance criteria suggests the proposed action would result in significant impacts, an EIS would be required.

This environmental review demonstrates that the impacts of this proposed project are not significant. The proposed action would benefit Yellowstone cutthroat trout in Sage Creek with minimal impact on the physical, biological, or the human environment.

The original and addendum EA's for Sage Creek were generally supported with very few negative comments. The local landowners, Crow Tribe, USFWS, and USFS have been supportive of the project and support the project.

2. Describe the level of public involvement for this project if any and, given the complexity and the seriousness of the environmental issues associated with the proposed action, is the level of public involvement appropriate under the circumstances?

This is a continuation of past efforts. Private landowners have provided access and support for the project. The Crow Tribe has an MOU with the state for cutthroat restoration.

3. Duration of comment period, if any. Date when comments are due. Mail or email address to send comments. Public comment will be from July 26th through August 10th, 2013.

Send comments to:

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APPENDIX A

PRIVATE PROPERTY ASSESSMENT ACT CHECKLIST

The 54th Legislature enacted the Private Property Assessment Act, Chapter 462, Laws of Montana (1995). The intent of the legislation is to establish an orderly and consistent process by which state agencies evaluate their proposed actions under the "Takings Clauses" of the United States and Montana Constitutions. The Takings Clause of the Fifth Amendment of the United States Constitution provides: "nor shall private property be taken for public use, without just compensation." Similarly, Article II, Section 29 of the Montana Constitution provides: "Private property shall not be taken or damaged for public use without just compensation..."

The Private Property Assessment Act applies to proposed agency actions pertaining to land or water management or to some other environmental matter that, if adopted and enforced without compensation, would constitute a deprivation of private property in violation of the United States or Montana Constitutions.

The Montana State Attorney General's Office has developed guidelines for use by state agency to assess the impact of a proposed agency action on private property. The assessment process includes a careful review of all issues identified in the Attorney General's guidance document (Montana Department of Justice 1997). If the use of the guidelines and checklist indicates that a proposed agency action has taking or damaging implications, the agency must prepare an impact assessment in accordance with Section 5 of the Private Property Assessment Act. For the purposes of this EA, the questions on the following checklist refer to the following required stipulation(s):

(LIST ANY MITIGATION OR STIPALTIONS REQUIRED, OR NOTE "NONE") None

DOES THE PROPOSED AGENCY ACTION HAVE TAKINGS IMPLICATIONS UNDER THE PRIVATE PROPERTY ASSESSMENT ACT?

YES	NO		
	X	1.	Does the action pertain to land or water management or environmental regulation affecting private real property or water rights?
_____	_____	2.	Does the action result in either a permanent or indefinite physical occupation of private property?
	X	3.	Does the action deprive the owner of all economically viable uses of the property?
_____	_____	4.	Does the action deny a fundamental attribute of ownership?
_____	X	5.	Does the action require a property owner to dedicate a portion of property or to grant an easement? [If the answer is **NO**, skip questions 5a and 5b and continue with question 6.]
	X	5a.	Is there a reasonable, specific connection between the government requirement and legitimate state interests?
_____	_____	5b.	Is the government requirement roughly proportional to the impact of the proposed use of the property?
_____	_____	6.	Does the action have a severe impact on the value of the property?
_____	_____	7.	Does the action damage the property by causing some physical disturbance with respect to the property in excess of that sustained by the public generally? [If the answer is **NO**, do not answer questions 7a-7c.]
	X	7a.	Is the impact of government action direct, peculiar, and significant?
_____	_____	7b.	Has government action resulted in the property becoming practically inaccessible, waterlogged, or flooded?
_____	_____	7c.	Has government action diminished property values by more than 30% and necessitated the physical taking of adjacent property or property across a public way from the property in question?

Taking or damaging implications exist if **YES** is checked in response to question 1 and also to any one or more of the following questions: 2, 3, 4, 6, 7a, 7b, 7c; or if **NO** is checked in response to questions 5a or 5b.

If taking or damaging implications exist, the agency must comply with Section 5 of the Private Property Assessment Act, to include the preparation of a taking or damaging impact assessment. Normally, the preparation of an impact assessment will require consultation with agency legal staff.

Addendum A

Updated water quality discussion provided by Carol Endicott.

This project would involve discharge of rotenone into Sage Creek. Rotenone is an insecticide formerly used in organic agriculture and home gardening, as well as being an effective piscicide. Rotenone comes from the roots and stems from a variety of tropical and subtropical plants in the pea family (Fabaceae). The molecular constituents of rotenone are carbon, hydrogen, and oxygen and detoxification entails breaking rotenone into these nontoxic components. Rotenone is relatively inexpensive and accessible, and is a routine method to remove unwanted fish from lakes and streams. Rotenone acts by blocking the ability of tissues to use oxygen, which causes fish to asphyxiate quickly.

Rotenone is a highly reactive molecule, a factor favoring its quick decomposition in the environment. This degradability is in marked contrast to some pesticides used in nonorganic agriculture. Organochlorines are synthetic pesticides comprised of chlorinated hydrocarbons, and include chemicals such as DDT, heptachlor, and chlordane. These compounds persist in the environment long after their release, making the behavior and fate of organochlorine pesticides substantially different from rotenone, which breaks down within days, or less, in a stream or soil environment.

Organophosphates are another class of pesticide that differs markedly from rotenone in terms of threats to human health and the environment. Commonly used organophosphate pesticides include malathion, parathion, and diazinon. Although these chemicals are considerably less persistent than the organochlorines, they are more acutely toxic, and act as potent neurotoxins. Organophosphate poisonings are one of the most common causes of poisoning worldwide. In contrast, rotenone does not share this acute toxicity to humans with the organophosphate pesticides.

CFT Legumine™ (Prentiss 2007) is the rotenone formulation proposed for this project. The EPA has registered this formula (Reg. No. 75338-2), and approved its use as a piscicide. Information on its chemical composition, persistence in the environment, risks to human health, and ecological risks come from a number of sources including material data safety sheets

(MSDS) and manufacturer's instructions. (A MSDS is a form detailing chemical and physical properties of a compound, along with information on safety, exposure limits, protective gear required for safe handling, and procedures to handle spills safely.) In addition, Fisher (2007) analyzed the concentrations of major and trace constituents in CFT Legumine, evaluated the toxicity of each, and examined persistence in the environment.

The MSDS for CFT Legumine lists three categories of ingredients for this formula (Table 2). Rotenone comprises 5% of CFT Legumine by weight. Associated resins account for 5%, and the remaining 90% are inert ingredients, of which the solvent n-methylpyrrolidone is a component. Additional information in the MSDS confirms rotenone's extreme toxicity to fish.

Table 8: Composition of CFT Legumine from material safety data sheets (MSDS)

Chemical Ingredients	*Percentage by Weight*	*CAS. No.*[1]	*TLV*[2] *(units)*
Rotenone	5.00	83-79-4	5 mg/m^3
Other associated resins	5.00		
Inert ingredients including n-methylpyrrolidone	90	872-50-4	Not listed

[1]Chemical abstracts number

[2]A TLV reflects the level of exposure that the typical worker can experience without an unreasonable risk of disease or injury (see 2.2.3 . Risks/Health Hazards)

Analysis of the chemical composition of CFT Legumine found that on average, rotenone comprised 5% of the formula (Fisher 2007), consistent with MSDS reporting. Other constituents were solvents or emulsifiers added to assist in the dispersion of the relatively insoluble rotenone. DEGEE, or diethyl glycol monoethyl ether, a water-soluble solvent, was the largest fraction of the CFT Legumine analyzed. Likewise, n-methylpyrrolidone comprised about 10% of the CFT Legumine. The emulsifier Fennedefo 99™ is an inert additive consisting of fatty acids and resin acids (by-products of wood pulp and common constituents of soap formulations), and polyethylene glycols (PEGs), which are common additives in consumer products such as soft drinks, toothpaste, eye drops, and suntan lotions. Trace constituents included exceptionally low concentrations of several forms of benzene, xylene, and naphthalene. These organic compounds were at considerably lower concentrations than measured in Prenfish, another commercially available formulation of rotenone, which uses hydrocarbons to disperse the piscicide. Their presence in trace amounts in CFT Legumine relates to their use as solvents in extracting rotenone from the original plant material.

Table 9: Average percent concentrations and ranges of major constituents in CFT Legumine lost (Fisher 2007).

Major CFT LegumineFormula	*Rotenone*	*Rotenolone*	*n-methylpyrrolidone*	*DEGEE*[1]	*Fennedefo 99*

Constituent					
Average %	5.12	0.718	9.8	61.1	17.1
Range	4.64-5.89	0.43-0.98	8.14-10.8	58.2-63.8	15.8-18.1

[1]diethyl glycol monoethyl ether

Persistence in the environment and toxicity to nontarget organisms are major considerations in determining the potential risks to human health and the environment, and several factors influence rotenone's persistence and toxicity. Rotenone has a half-life of 14 hours at 24 °C, and 84 hours at 0 °C (Gilderhus et al. 1986, 1988), meaning that half of the rotenone is degraded and is no longer toxic in that time. As temperature and sunlight increase, so does degradation of rotenone. Higher alkalinity (>170 mg/L) and pH (>9.0) also increase the rate of degradation. Rotenone tends to bind to, and react with, organic molecules rendering it ineffective, so higher concentrations are required in streams with increased amounts of organic matter. Without detoxification, rotenone would degrade to nontoxic levels in one to several days due to its break down and dilution in the aquatic environment.

Mitigative activities proposed would further reduce the spatial and temporal extent of rotenone toxicity. A detoxification station established immediately below the constructed barrier would release $KMnO_4$ up to the effective concentration of 0.5 to 1 ppm. This strong oxidizer rapidly breaks down rotenone into its nontoxic constituents of carbon, oxygen, and hydrogen, with total breakdown occurring within 15 to 30 minutes of exposure, which is typically ¼ to ½-miles stream travel time. $KMnO_4$ in turn breaks down into potassium, manganese, and water, which are common constituents in surface waters, and have no deleterious effects at the concentrations used (Finlayson et al. 2000). In addition, $KMnO_4$ is a commonly used oxidizer in wastewater treatment plants, so its release into streams and rivers is a regular and widespread phenomenon. The result of release of $KMnO_4$ on water quality would be elimination of toxic concentrations of rotenone. An additional back up detoxification station would be on-site and deployed if necessary.

The concentration of rotenone in treated waters is another factor relating to potential effects from incidental ingestion by other organisms, including humans. The effective concentration of rotenone is 0.025 to 0.05 ppb, which is roughly equivalent to 1/400 to 1/800 of a grain of table salt per liter. The National Academy of Sciences suggested concentrations of 14 ppm (about 8,900 grains of salt per liter) pose no adverse effects to human health from chronic ingestion of water (National Academy of the Sciences 1983). Moreover, concentrations associated with acute toxicity to humans are 300-500 mg per kilogram of body weight (Gleason et al. 1969), which means a 160-pound person would have to drink over 23,000 gallons in one sitting to receive a lethal dose (Finlayson et al. 2000). Similarly, risks to wildlife from ingesting treated water are exceptionally low. For example, ¼-pound bird would have to consume 100 quarts of treated water, or more than 40 pounds of fish and invertebrates, within 24 hours, for a lethal dose (Finlayson et al. 2000). The EPA, in their recent

reregistration evaluation of rotenone (EPA 2007), concluded that exposure to rotenone, when applied according to label instructions, presented no unacceptable risks to humans and wildlife. In summary, this project would have no adverse effect on humans or wildlife associated with ingesting water, dead fish, or dead invertebrates.

Bioaccumulation of rotenone would not result in threats to human health and the environment under the preferred alternative. Rotenone can bioaccumulate in the fat tissues of fish that are not exposed to toxic levels (Gingerich and Rach 1985). As a complete fish-kill is the goal, and application will occur over a short time period, bioaccumulation would not be a problem. Moreover, breakdown of rotenone in killed fish and invertebrates would also be rapid, so scavengers, such as skunks, mink, or birds would not experience chronic exposure.

Potential toxicity and persistence of the other constituents of the CFT Legumine formulation are additional considerations. Proposed concentrations of n-methylpyrrolidone (about 2 ppm) would have no adverse effects to humans ingesting treated waters. According to the MSDS, ingestion of 1000 ppm per day for three months does not result in deleterious effects to humans. In addition, n-methylpyrrolidone would not persist in surface waters given its high biodegradability. This rapid degradation, combined with its low toxicity, makes n-methylpyrrolidone a commonly used solvent in wastewater treatment plants.

Fisher (2007) examined the toxicity and potential persistence of other major constituents in CFT Legumine, including DEGEE, fatty acids, PEGs, and trace organic compounds, (benzene, xylene, naphthalene). With proposed application of CFT Legumine, none of these compounds would violate water quality standards, nor would they reach concentrations shown to be harmful to wildlife or humans. Furthermore, persistence of these chemicals was not a concern. The trace organics would degrade rapidly through photolytic (sunlight) and biological mechanisms. Likewise, the PEGs would biodegrade in a number of days. The fatty acids would also biodegrade, although they would persist longer than the PEGs or benzenes. Nonetheless, these are not toxic compounds, so the relatively longer persistence would not adversely affect water quality. The trace organics would be at exceptionally low concentrations given dilution of the formula present in the drip station, followed by dilution in the stream. These organic compounds would be well below laboratory detection limits or levels that are harmful. Moreover, these are moderately to highly volatile chemicals that would break down through the same mechanisms as rotenone, namely oxidation, dilution, and treatment with $KMnO_4$. Overall, the low toxicity, low persistence, and lack of bioaccumulation indicate the inert constituents in CFT Legumine would have a minor and temporary effect on water quality.

To reduce the potential risks associated with the use of CFT Legumine, the following management practices, mitigation measures, and monitoring efforts would be employed:

1. A pretreatment bioassay would be conducted to determine the lowest effective concentration and travel time of the chemical in the stream.
2. Signs would be posted at trailheads and along the stream to warn people not to drink the water, consume dead fish, or have recreational contact with the water.
3. Piscicide would be diluted in water and dripped into the stream at a constant rate using a device that maintains a constant head pressure.
4. A detoxification station would be set up downstream of the target reach. $KMnO_4$ would neutralize the piscicide at this location.
5. An additional detoxification would be established downstream from the initial detoxification station as a safeguard.
6. Project personnel would be trained in the use of these chemicals including the actions necessary to deal with spills as prescribed in the MSDS for CFT Legumine.
7. Persons handling the piscicide would wear protective gear as prescribed in the CFT Legumine label.
8. Only the amount of piscicide and potassium permanganate that is needed for immediate use would be held near the stream.
9. Sentinel or caged fish would be located below the detoxification station and within the target reach to determine and monitor the effectiveness of both the rotenone and $KMnO_4$.

The presence and fate of dead fish would be another potential alteration of water quality associated with piscicide treatment. Experience has shown that these fish sink in streams and are difficult to find within a few days. Leaving their carcasses to decompose within the stream would keep their nutrients available to the next generation of organisms. This increase in nutrients would likely, temporarily increase biomass of algae, macroinvertebrates, and fish.

Comment 2f: Effects on Groundwater

Investigations on the fate and transport of rotenone in soil and groundwater indicate this project would not alter groundwater quality. Rotenone binds readily to soils and is broken down by soil and in water (Engstrom-Heg 1971; Dawson et al. 1991; 1976; Skaar 2001; Ware 2002). Because of its strong tendency to bind with soils, its mobility in most soil types is only one inch; although, in sandy soils, rotenone can travel up to three inches (Hisata 2002). Combined, the low mobility and rapid break down prevents rotenone from contaminating groundwater.
Groundwater investigations associated with several piscicide projects also indicate application of rotenone, and the inert ingredients, would not threaten groundwater quality. California investigators monitored groundwater in wells adjacent to, and downstream of, rotenone projects, and did not detect rotenone, rotenolone, or any of the other organic

compounds in the formulated products (CDFG 1994). Likewise, case studies in Montana have concluded that rotenone movement through groundwater does not occur. For example, FWP monitored a domestic well two weeks and four weeks after applying 90 ppb of rotenone to Lake Tetrault (FWP, unpublished data). This well was down gradient from the lake, and drew water from the same aquifer that drained and fed the lake; however, no rotenone or associated constituents were detectable. FWP monitored groundwater associated with several other rotenone projects, with wells ranging from 65 to 200 feet from the treated waters. Repeated sampling occurred within periods of up to 21 days, with no detectable concentrations of rotenone or the inert ingredients found.

One domestic well lies relatively close to the lower end of the treatment area (GWIC database 2012). This well is 1,900 feet from the proposed barrier site and 1,200 feet from the detoxification reach. Given the minute distance rotenone travels through soils (1 to 3 inches), its low mobility in groundwater, and its rapid breakdown, this project would not result in contamination of the neighboring well.

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